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ABSTRACT

This study measured the increase of heart rate during reading (over a baseline rate when the subject was at rest) caused by anticipation of comprehension questions to follow. It also investigates correlations between heart rate and reading speed and comprehension. Twenty-four college subjects, considered normal readers according to SAT-Verbal performance, read one of four semantically identical passages controlled in interest level and varying in readability from grade levels 9 through 17. Heart rate was recorded during rest and during reading conditions. Conclusions of the study, overturning previous research, state that heart rate is not directly linked to cognitive activity. Need for further psychophysiological research, particularly with children, is recommended. (MAI)

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HEART RATE DURING READING

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Psychophysiological correlates of the reading process have been empirically investigated for about a century (Huey, 1968). While the literature is replete with studies of eye movements, subvocalization, and electrical activity of the brain during reading, a paucity of research exists which has investigated the role the heart plays in the processing of printed text.

Only two studies have required subjects to read continuous text while measuring heart rate. The first, reported by Wark (1972) in the NRC 21st Yearbook, found that subject's heart rate decreased during reading but increased when reading was to be followed by comprehension questions. Reichurdt (1977) did not report data but did state that

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his population, remedial readers, exhibited differential changes. The lowest achieving readers experienced a heart rate decrease during reading, while the next lowest group experienced a heart rate increase when reading. And, when given a questioning condition, subjects did not show any heart rate change over a baseline.

With these somewhat contradictory results, the present study was designed to test whether, under a question following condition, heart rate would increase, as predicted by Wark (and Lacey (1963, 1967) among others) over a resting baseline when reading. Additionally, Reichurdt's description and some results from psychophysiological investigations of cognition would hold that correlations between factors of reading and the reader's perception of the task, as measured by physiological variables, would be moderate. Accordingly, correlations between speed of reading and heart rate and between comprehension scores and heart rate were investigated.

Method

The 24 college subjects used in the experiment were normal readers, as determined by SAT-Verbal performance. They read one of four semantically identical passages controlled for interest level but varying in readability from grade levels nine through seventeen (Fry, 1977). All passages were 500 words in length; they were assigned to subjects in a random order. The passages were shown via a slide projector with the subject controlling the rate of presentation. Heart rate was recorded during rest, reading, and rest conditions.

Instrumentation

Heart rate was recorded by placing a Grass E5S silver cup electrode on the right forearm. The referrant electrode was affixed to the left earlobe. Electromyographic activity passing between these two points was recorded, with the heart beat being the single most distinct signal. This signal was recorded via a Beckman 8 channel RM Dynograph. An on-line integrator summed and averaged the heart muscle action potentials every five seconds.

Results

MANOVA results did not support the first hypothesis. While heart rate did increase over rest when reading for most subjects, this increase was not significant ($F_{2,40}=.86$).

To determine whether performance by the subject was related to heart rate, Pearson correlations were computed. The relationship between heart rate and speed of reading yielded a -.05 correlation. Comprehension score and heart rate resulted in a +.007 correlation. The two reading factors, exclusive of heart rate, resulted in a -.24 correlation, which would be expected. None of the correlations was significantly different from 0.

Discussion

Results of the present study do not support those of Wark (1972) or Lacey (1963, 1967). Under a questioning condition, heart rate would be expected to increase significantly over the resting baseline. Reichurdt reported that no change was evident when remedial college readers were required to read with questions following. The present study extends this finding to include normal college readers reading under a variety of gradated difficulty passage conditions.

The almost negligible correlations support the notion that heart rate is not directly linked to cognitive activity, especially a complex one like reading. Rather, heart rate change during cognitive tasks is probably serving as a physiological mediator to somatic activity required by the cognitive functioning (Elliot, 1972).

Psychophysiological research of reading processes should continue to include a measure of heart rate because its inclusion enables data to be grouped by a direct measure of general arousal. Finally, heart rate data on younger readers, especially beginning readers, needs to be collected. At these early stages, the possibility exists that widely divergent responses to reading may be observed through changes in heart rate.

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